



NATIONAL OPEN UNIVERSITY OF NIGERIA
University Village Plot 91, Cadastral Zone, Nnamdi Azikiwe Expressway, Jabi, Abuja

FACULTY OF SCIENCES
DEPARTMENT OF MATHEMATICS
2021_1 Examinations

Course Code: MTH304
Course Title: COMPLEX ANALYSIS
Time Allowed: 3 Hours
Total: 70 Marks
Instruction: Answer Question One (1) and Any Other 4 Questions

1. a. Define a complex number. (6 marks)
b. Let c be the circle $|z|=4$. Evaluate the integral $\int_c \frac{\cos z}{z^2-6z+5} dz$ (10 marks)
c. What is the value of x, y in equations below:
 - i. $(u, v) + (a, v) = (x, y)$ (3 marks)
 - ii. $(8,1) + (x, y) = (10,1)$ (3 marks)
2. a. Prove that $|z + w|^2 \leq |z|^2 + |w|^2$ (4 marks)
b. Write in polar form $re^{i\theta}$ i. $-2\sqrt{3} + 3i, 1 + i$ (4 marks)
c. What is a vector valued function? (4 marks)
3. a. Suppose $f(z) = z^2$. What is $\lim_{z \rightarrow z_0} \frac{f(z) - f(z_0)}{z - z_0}$? (4 marks)
b. Suppose the function f given by $f(z) = u(x, y) + iv(x, y)$ has a derivative at $z = z_0 = (x_0, y_0)$. Derive Cauchy Riemann Equations. (4 marks)
c. if f has a derivative at a point z , then its real and imaginary parts satisfied which equations(list them) (4 marks)
4. a. If $z = x + iy$, find the equation of the locus $\left| \frac{z+1}{z-1} \right| = 2$ (4 marks)
b. When is a function $f(z)$ said to be analytic? (4 marks)
c. Define Cauchy integral formula (4 marks)
5. a. Define power series. (4 marks)
b. i. What are conjugates? (2 marks)
Determine the values of x and y from the following
ii. $(u, v) + (a, v) = (x, y)$ iii. $(8,1) + (x, y) = (10,1)$ (2 marks)
c. Show that $\frac{1}{z(z-1)} = \sum_{j=2}^{\infty} z^{-j}$ (4 marks)

6a. When are two complex numbers said to be equal?

(4 marks)

b. Find the $\lim_{x \rightarrow 0} \left\{ \frac{\tan x - x}{x^3} \right\}$

(4 marks)

c. Compute $\int_C \frac{1}{(z^2+4)^2} dz$ over the contour shown below

(4 marks)

